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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

9M

Office Action Summary	Application No. 09/976,739	Applicant(s) WOOTEN ET AL.
	Examiner Kevin Siangchin	Art Unit 2623

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-20 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 11 October 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 2/10//01,4/4/03.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

Detailed Action

Claims

Rejections Under 35 U.S.C. § 112(2)

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-2, 4, 8, 12, 16, and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

3. *The following is in regard to Claims 4, 8, and 19.* Claims 4, 8, and 19 claim to store the coordinates of a first and second *process signature*. The Applicant has not adequately defined the term *process signature*, nor can its meaning be gleaned from the Applicant's specification. As a result, claims 4, 8, and 19 are rendered unclear. As indicated by the Applicant (page 2, lines 1-3), detected spatial signatures are associated "with a particular process step or piece of process equipment". Seen in this light, a *defect spatial signature* can be reasonably interpreted as representing a *process signature*, since, being peculiar to a particular process or tool, it is indicative of the associated process step or piece of process equipment. This interpretation of the term *process signature* will be adopted henceforth in this document.

4. *The following is in regard to Claims 1, 12, and 16.* Claims 1, 12, and 16 characterize the claimed defect spatial signatures, process anomalies, and defect maps, respectively, as being *uncategorized.* The general meaning of the word is understood – that is, not grouped into distinct classes or categories. However, within the context of the Applicant's claimed invention and, more particularly, when used in conjunction with the aforementioned aspects of claims 1, 12, and 16, the Applicant's usage of the word uncategorized becomes unclear. It cannot be ascertained from Applicant's disclosure how the Applicant considers the defect spatial signatures, process anomalies, or defect maps uncategorized. To realize this ambiguity consider the following example. A defect spatial signature may not be categorized according to shape or location, but may be categorized according to other aspects, such as size. In this case, such a defect spatial signature can be considered categorized (i.e. not *uncategorized*). Conversely, one can consider the spatial signature to be uncategorized, at least, with respect to shape and location. This ambiguity arises when broadly distinguishing items as being *uncategorized,* without discussing some mode of categorization. Furthermore, such a distinction conflicts with other aspects of claims 1, 12, and 16, as well as subsequent dependent claims. For instance, by virtue of being stored in a database (claim 1) – even, a relational database – the defect spatial signatures, etc. must be categorized. Also, according to claim 9, defect spatial signatures are categorized as being attributable to particle contamination, mechanical surface damage, etc. In this way, the spatial signatures of claim 9 seem to contradict the *uncategorized* limitation of claim 1. In summary, by not specifying how the defect spatial signatures, process anomalies, and defect maps of claims 1, 12, and 16, respectively, are *uncategorized*, the language of claims 1, 12 and 16 is ambiguous. In other words, these claims are unclear, because

they fail to resolve against what the defect spatial signatures, process anomalies, and defect maps are *uncategorized*.

5. The word *uncategorized* will be interpreted, henceforth in this document, in a manner similar to the example above. That is, although an item maybe categorized in some respect(s), if it is uncategorized in another respect, then that item will be assumed to be uncategorized, at least with regard to latter respect. When it is deemed necessary, the assumed mode of categorization (i.e. the "respect" with which an item is judged as categorized or uncategorized) will be explicitly indicated.

6. *The following is in regard to Claims 2 and 16.* Claims 2 recites the limitation: "the defect database contains uncorrelated data" (i.e. defect spatial descriptors, according to claim 1). Similarly, Claim 16 the defect maps of the plurality of [stored] defect maps are uncorrelated and uncategorized". Regarding claim 2, dependant claim 4 states that "the coordinates of the process signatures of the first and second defects are in relation to each other", where, in light of the specification (Applicant's Fig. 3), the first and second defect signatures are presumably stored in the defect database. Furthermore, according to claim 6, the recent defect spatial signature is added to the defect database, although, according to claim 1, "the recent defect spatial signature [may correspond] to at least one of the defect spatial signatures of the defect database". Claims 4 and 6 seem to indicate a correlation between data contained in the defect database, whereas, Claim 2 asserts that these data are uncorrelated. The contradiction between these claims should thus be apparent (a similar case can be made for claim 16). With regard to claims 2 and 16, the word *uncorrelated* will be interpreted simply as *different*, henceforth in this document.

Rejections Under 35 U.S.C. § 112(1)

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claim 1-2, 4-5, 8, 10, 12-14, 16, and 19-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

9. *The following is in regard to Claims 1, 12, and 16.* These claims respectively propose that the defect spatial signatures, process anomalies, and defect maps are uncategorized. It cannot be readily determined from the Applicant's disclosure how these items are uncategorized. It seems, contrarily, that these items are indeed categorized – for example, by being attributable to certain process steps (e.g. at least one of particle contamination, mechanical surface damage, wafer spinning processes, scratching, and polishing – Claim 9). Furthermore, it seems, at least implicitly, that these defects require categorization in order for the Applicant's claimed method to operate as intended. The Applicant's disclosure seems to imply that the sources of these defects are numerous and diverse (page 1, lines 18-20). Therefore, without some mode of categorization, it begs the question: how can, for example (page 3, lines 30-31), the engineer take measures to adjust the manufacturing process to circumvent the detected defects?

10. *The following is in regard to Claim 2, 10 and 16.* These claims respectively propose that the defect spatial signatures, process anomalies, and defect maps are uncorrelated. Indeed, according to the Applicant's disclosure (page 4, lines 14-18), this is advantageous. However, it seems that the Applicant contradicts these claims be stating:

> The wafer map of the first wafer is reconstructed from the relational database (reference number 29) and the wafer maps of the two wafers are electronically analyzed to determine if the wafer map of the first wafer correlates to that of the second wafer within a predetermined confidence level (reference number 31). If a match within the predetermined confidence level occurs, then the computer reports that a match has been encountered. The engineer is notified and can then review the process history of the first wafer with that of the second wafer to discover at which step in the process the defect occurred [page 3, lines 23-28 of the Applicant's disclosure].

Since the defect signatures, etc. are subsequently stored (including the "query" or "recent" ones – e.g. Claim 6), it would seem from this statement that, contrary to what is claimed, the content of the defect database – i.e. defect spatial signatures, process anomalies, and defect maps – are correlated.

11. *The following is in regard to Claim 4, 8, 13, and 19.* These claims propose storing coordinates of a process signatures, etc. of a first defect and storing coordinates of a process signature, etc. of a second defect in the defect database. This is more specific than the process disclosed in the Applicant's specification. There is no mention in the specification of storing coordinates.

12. *The following is in regard to Claim 5, 14, and 20.* These claims propose creating a *local density* of defects for each wafer. There is no mention in the Applicant's specification of a local density of defects for each wafer. However, the Applicant does specify that "the defects are clustered using mathematical clustering techniques or using a stylus and a pad" (page 3, lines 14-15). A cluster of defects and a local density of defects can scarcely be considered the same. These terms have distinct meanings in the field of image analysis or data analysis, in general. In light of this fact, clustering

defects cannot reasonably be considered the same as creating a local density of defects.

Rejections Under 35 U.S.C. § 102(e)

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

14. Claims 1-2, 10-12, and 15-16 are rejected under 35 U.S.C. 102(e) as being anticipated by Farrell et al.

15. *The following is in regard to Claim 1.* Ferrell et al. disclose a method for performing defect spatial signature (*numerical descriptors* or *feature vectors*[1] – Farrell et al. column 2, lines 55-59, column 4, lines 64-67 and column 5, lines 6-9) analysis of a semiconductor process (Farrell et al. column 2, lines 8-33 and lines 36-41). The method of Farrell et al. comprises:

(1.a.) Creating a defect database of wafers having defect spatial signatures – for example, the *Image Database* 5 of Farrell et al. Fig.1 or the *hierarchical search tree* (Farrell column 3, lines 15-17). Note that the latter is a data structure that comprises searchable data arranged in a

[1] The numerical descriptors (feature vectors) incorporate, *inter alia,* shape (Farrell et al. column 6, lines 39-42) and location (e.g. centroid – Farrell et al. column 7, lines 23-28). Since these are strictly spatial characteristics and correspond to a defect(s), the numerical descriptors represent *defect spatial signatures.*

structured fashion and, in that respect, represents a database. The *hierarchical search tree* (HST) will be referred to interchangeably with *defect database*, henceforth in this document.

The defect spatial signatures in the defect database are *uncategorized* data in that:

1. They can correspond to unclassified defects (Farrell et al. column 13, lines 3-5).
2. Their arrangement in the HST is according to their relative similarity (Farrell et al. column 9, lines 48-56) , as opposed to some defect classification schema.

(1.b.) Generating a recent defect spatial signature (e.g. steps 14-16 of Farrell et al. Fig. 3A). Though any of the stored feature vectors can be regarded as being recent (since the term recent is highly relative), the query vector(s) (Farrell et al. column 3, lines 39-41) will be assumed, herein, to represent the *recent* defect spatial signature. It is, perhaps, most recent with respect to the stored feature vectors.

(1.c.) Determining if the recent defect spatial signature corresponds to at least one of the defect spatial signatures of the defect database (Farrell et al. column 11, lines 21-38).

It has thus been shown that the method of Farrell sufficiently conforms to the method set forth in Claim 1.

16. *The following is in regard to Claim 2.* As shown above, the method of Farrell et al. adequately satisfies the limitations of claim 1. Furthermore, the leaf nodes (e.g. V1, V2, V3, ... of Farrell et al. Fig. 6) in the HST of Farrell et al.'s method each encapsulate a feature vector (Farrell et al. column 3, line 19) and are added such that the

encapsulated feature vector is exclusive of the set of feature vectors present in the HST (Farrell et al. column 3, lines 30-33). In addition, redundant nodes are purged from the HST (Farrell et al. column 4, lines 15-17). As a result, one may conclude that the defect database (HST) contains essentially uncorrelated data.

17. *The following is in regard to Claim 10.* Ferrell et al. disclose a method for evaluating process anomalies (e.g. defects, represented by *numerical descriptors* or *feature vectors* – Farrell et al. column 2, lines 55-59, column 3, lines 4-6, column 4, lines 64-67 and column 5, lines 6-9) in a semiconductor process (Farrell et al. column 2, lines 8-33 and lines 36-41). The method of Farrell et al. comprises:

(10.a.) Generating a database of process anomalies – for example, the *Image Database* 5 of Farrell et al. Fig.1 or the *hierarchical search tree* (Farrell column 3, lines 15-17). Each of the feature vectors (or images of the Image Database 5 – Farrell et al. column 4, lines 54-56 and column 6, lines 6-9) represents or corresponds to an anomaly. As shown above, with respect to claim 2, these feature vectors, and hence the associated anomalies, are uncorrelated. Please refer to the discussion above.

(10.b.) Inspecting a wafer having at least one process anomaly (e.g. capturing an image of a wafer – Farrell et al. Fig. 3A, column 4, lines 59-67 and column 5, lines 6-9).

(10.c.) Determining if the at least one process anomaly corresponds to a process anomaly in the database of process anomalies (Farrell et al. column 11, lines 21-38).

It has thus been shown that the method of Farrell sufficiently conforms to the method set forth in Claim 10.

18. *The following is in regard to Claim 12.* As shown above, the method of Farrell et al. adequately satisfies the limitations of claim 10. Following the discussions above with regard to claims 1 and 10, it should be clear that the anomalies (as represented by the aforementioned feature vectors) are uncategorized.

19. *The following is in regard to Claim 15.* Ferrell et al. disclose a method for determining the occurrence of an anomalous event (e.g. a defect or anomaly – see above and Farrell et al. column 2, line 65 and column 8, lines 13-30). The method comprises:

(15.a.) Storing a plurality of defect maps (i.e. *defect masks* – Farrell et al. column 8, lines 16-18) in a storage device. These masks (presumably stored) are used to develop each feature vector in step 16 of Farrell et al. Fig. 3A (Farrell et al. column 9, lines 7-9), associated with the images stored in Image Database 5 of Farrell et al. Fig. 1 (Farrell et al. column 9, lines 20-21).

(15.b.) Creating a defect map (defect mask) of a recent anomalous event (e.g. a defect). See Farrell et al. column 3, lines 39-41 and note that the query image undergoes the same procedure as discussed above, wherein a defect mask is derived from the query image and used to determine the associated feature vector (Farrell et al. column 8, lines 13-30 and Fig. 3A).

(15.c.) Determining if the defect map of the recent anomalous event corresponds to one of the plurality of defect maps in the storage device (Farrell et al. column 11, lines 21-38).

It has thus been shown that the method of Farrell sufficiently conforms to the method set forth in Claim 15.

20. *The following is in regard to Claim 16.* As shown above, the method of Farrell et al. adequately satisfies the limitations of claim 15. It was shown above, with respect to claims 1 and 2, that the feature vectors stored in the HST were essentially uncorrelated and uncategorized. Given their direct association with these feature vectors, the defect maps (defect masks) are, by implication, uncorrelated and uncategorized.

Rejections Under 35 U.S.C. § 103(a)

21. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

22. Claims 3-5, 8, 13-14, and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farrell et al., in view of La et al. (U.S. Patent 5,761,064).

23. *The following is in regard to Claim 3.* As shown above, the method of Farrell et al. adequately satisfies the limitations of claim 1. Farrell et al. do not expressly show or suggest that the defect database (e.g. *Image Database* 5 of Farrell et al. Fig.1 or the aforementioned *hierarchical search tree*).

24. Relational databases have had a broad range of applications, in nearly every conceivable industry, to various types and forms of data. It is no surprise, therefore, that they have seen widespread application to the various data encountered in the

semiconductor industry. For example, La et al. disclose an automated defect management system in which semiconductor wafer defect are collected from wafer inspection instruments (La et al. Abstract). The wafer defect data, which includes spatial information (e.g. reference numbers 144, 146, 148, 150, and 152 of La et al. Fig. 3), is stored in a central database system consisting of a *relational* database (La et al. column 3, lines 51-53).

25. The teachings of La et al. and Farrell et al. are combinable because they are analogous art – that is, each relate the field of defect detection and analysis and defect information storage. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to use, as La et al. suggests, a relational database for the storage of defect information, such as the feature vectors of Farrell et al. The relational model used in relational database systems is particularly advantageous over other database schema, because it requires few assumptions about relationships between the disparate data contained in the database. This resolves much of the data inconsistency and scalability issues that plague so-called *flat-file* databases.

26. *The following is in regard to Claim 18.* Claim 18 recites essentially the same limitations as claim 9. Therefore, with regard to claim 18, remarks analogous to those presented above relative to claim 9 are applicable.

27. *The following is in regard to Claim 4.* As shown above, the teachings of Farrell et al. can be combined with those of La et al. so as to adequately satisfy the limitations of claim 3. In addition, Farrell et al. further disclose storing coordinates (e.g. the centroid (X_C, Y_C) – Farrell et al. column 7, lines 23-28) of a process signature of a first defect (i.e. the feature vector, in the collection of feature constituting the *vector list*, corresponding to, say, a "first" defect – Farrell et al. Fig. 3A) and storing coordinates of a process

signature of a second defect (i.e. the feature vector, in the collection of feature constituting the *vector list*, corresponding to, say, a "second" defect – Farrell et al. Fig. 3A). For the centroid to be meaningful, its coordinates must be expressed relative to some fixed coordinate system, preferably scaled and stationed fixedly with respect to the image, or other measured representation, of the defect or wafer. In this manner, the coordinates of the process signatures of the first and second defects would be inherently in relation to each other.

28. *The following is in regard to Claim 19.* Claim 19 recites essentially the same limitations as claim 3. Therefore, with regard to claim 19, remarks analogous to those presented above relative to claim 3 are applicable.

29. *The following is in regard to Claim 8 and 13.* As shown above, the method of Farrell et al. adequately satisfies the limitations of claim 1. Heeding the discussions above with respect to claims 3 and 4, it should be clear that the method, obtained by combining the teachings of Farrell et al. and La et al. in the manner proposed above, would involve:

(8.a.) Creating a relational database of defects. Refer to the discussion above relating to claim 3.

(8.b.) Storing coordinates of a process signature of a first defect and storing coordinates of a process signature of a second defect, wherein the coordinates of the process signatures of the first and second defects are relative to each other. Refer to the discussion above relating to claim 4.

30. By adopting the same interpretation of process anomalies as used in claim 10 (i.e. that process anomalies are defects, represented by *numerical descriptors* or *feature vectors* – Farrell et al. column 2, lines 55-59, column 3, lines 4-6, column 4, lines 64-67

and column 5, lines 6-9), it should be evident that previous discussion relating to claim 8 sufficiently addresses the limitations set forth in claim 13.

31. *The following is in regard to Claim 5.* As shown above, the teachings of Farrell et al. can be combined with those of La et al. so as to adequately satisfy the limitations of claim 3. La et al. further suggest the inclusion of *defect density* in the wafer defect data used for analysis (La et al. column 6, lines 49-50 and line 54). The defect density is, at least, local to wafer under observation. Furthermore, since *density,* as a physical measure, is inherently mathematical in nature (generally, a quantity [e.g. mass, number of defects, etc.] divided by a unit spatial quantity [e.g. unit volume, unit area, unit length, unit wafer surface-area, etc.]), the defect density would necessarily be derived according to a mathematical formulation.

32. *The following is in regard to Claims 14 and 20.* Claims 14 recites essentially the same limitations as claim 5. Therefore, with regard to claims 14 and 20, remarks analogous to those presented above relative to claim 5 are applicable.

33. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Farrell et al., in view of Jain et al. (U.S. Patent 5,893,095).

34. *The following is in regard to Claim 6.* As shown above, the method of Farrell et al. adequately satisfies the limitations of claim 1. Farrell et al., however, do not expressly show or suggest adding the recent defect spatial signature (i.e. the query vector) to the defect database.

35. Jain et al. disclose a method for content-based search and retrieval of stored visual objects (e.g. imaged defects) based on similarity of content to a target (query)

visual object (Jain et al. Abstract and Field of Invention). Like Farrell et al.'s method, the method of Jain et al. accepts a query image (Jain et al. column 4, lines 29-30 and Fig. 5A, steps 242 and/or 247), derives a feature vector (Jain et al. Fig. 5A, step 122 and column 12, lines 26-38) corresponding to the visual attributes (i.e. *primitives* – Jain et al. column 4. lines 2-8, column 6, lines 36-37, and column 8, lines 6-11) of the image, and determines a set of feature vectors, stored in a database (e.g. database 132 or FV_i storage 264 of Jain et al. Fig. 5B), that are sufficiently similar (i.e. correspond to) the input query vector (Jain et al. Fig. 5B). These feature vectors are analogous to the defect spatial signatures discussed above[2]. As suggested by Jain et al. (Jain et al. Fig. 5B, step 247, column 11, lines 60-65 and column 21, lines 30-38), the query feature vector (i.e. the "recent" defect spatial signature – see above) may be added to the defect database.

36. The teachings of Jain et al. and Farrell et al. are combinable because they are analogous art. The functional and structural similarities of the two disclosed methods should be apparent. Moreover, Jain et al. suggests the application of their system and method to defecting and analyzing defects in semiconductor wafers (Jain et al. column 16, line 59 and 63-67 and column 4, line 67 to column 5, lines 1-3). Therefore, given the teachings of Jain et al., it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to add the recent defect spatial signature (i.e. the query vector) to the defect database. The motivation to do so would have been to provide persistent availability (via the data persistence offered by a database) to past defect queries.

[2] The *primitives* comprising the query feature vector used in the method of Jain et al. incorporate spatial derived spatial characteristics of the query image (Jain et al. column 4, lines 2-4 and column 8, lines 1-9).

37. Claims 7, 11, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farrell et al., in view of Tobin et al. (U.S. Patent 6,535,776).

38. *The following is in regard to Claim 7.* As shown above, the method of Farrell et al. adequately satisfies the limitations of claim 1. Farrell et al., however, do not expressly show or suggest adjusting a process if the recent defect spatial signature corresponds to at least one of the defect spatial signatures of the defect database.

39. Tobin et al. disclose a method for localizing and isolating an errant process step by "integrating content based image retrieval, CBIR [an approach similar to Farrell et al.], ... with a ... database of defect imagery and corresponding defect characterization data [e.g. feature vectors such as those of Farrell et al.] to diagnose a defective product and identify an errant process causing the defective product" (Tobin et al. column 2, lines 13-18). The method involves "providing to a content-based image retrieval engine, a query image depicting a defect; retrieving from the [database], a selection of images, each image having image content similar to image content extracted from the query image; and, ranking the selection of images according to a similarity metric" (Tobin et al. column 2, lines 43-49). Moreover, Tobin et al. suggest using this information (i.e. the similar [corresponding] defect image(s)) to "localize, isolate, and correct [adjust] an errant manufacturing process step" (Tobin et al. column 1, lines 61-65), corresponding to the set of images similar (corresponding) to the query image. In other words, adjusting a process if the recent defect spatial signature (i.e. defect characterization data – Tobin et al. column 3, lines 4-12) corresponds to at least one of the defect spatial signatures of the defect database.

40. The teachings of Tobin et al. and Farrell et al. are combinable because they are analogous art. Specifically, both Tobin et al. and Farrell et al. use a CBIR approach for

the detection of defects in semiconductor products. Therefore, given the teachings of Tobin et al., it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to adjusting a process if the recent defect spatial signature (the query feature vector of Farrell et al. or the defect characterization data of Tobin et al.) corresponds to at least one of the defect spatial signatures of the defect database. The motivation for doing so would have been to rectify errant processes that detract from the yield of the manufactured products.

41. *The following is in regard to Claim 11.* As indicated above, process anomalies correspond directly to defects and, therefore, defect spatial signatures. For this reason, they are treated as being essentially the same. Given this, Claim 11 recites essentially the same limitations as claim 7. Therefore, with regard to claims 11, remarks analogous to those presented above relative to claim 7 are applicable.

42. *The following is in regard to Claim 17.* As indicated above, Farrell et al. derive defect maps representing the defects of an observed wafer. The captured defect images used in Tobin et al.'s method can loosely be regard as being defect maps, as well. Taking this into account, it should be evident that remarks analogous to those presented above relating to claim 7 also apply to claim 17.

43. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Farrell et al., in view of the Applicant's admitted prior art, as disclosed in the Applicant's Background of Invention (pages 1-2 of the Applicant's disclosure). For the sake of brevity, the Applicant's admitted prior art will be referred to simply as Prior Art, henceforth in this document.

44. *The following is in regard to Claim 9.* As shown above, the method of Farrell et al. adequately satisfies the limitations of claim 1. Farrell et al., however, do not expressly show or suggest that the defect spatial signatures are from at least one of particle contamination, mechanical surface damage, wafer spinning processes, scratching, and polishing.

45. According to Prior Art (Prior Art, page 1, lines 18-20), "[e]vents capable of causing [semiconductor wafer] defects include, but are not limited to, particle contamination, scratching, polishing anomalies, wafer spinning processes, watermarks, particle stains, and micro-scratching".

46. The teachings of Farrell et al. and Prior Art are combinable because they are analogous art. Specifically, the teachings of both Farrell et al. and Prior Art are directed to methods that detect defects in semiconductor wafers, or the like, using image analysis in tandem with a defect database. Therefore, given that particle contamination, scratching, polishing anomalies, wafer spinning processes, watermarks, particle stains, and micro-scratching are typical defects found during semiconductor wafer manufacturing, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to accommodate defect spatial signatures (i.e. feature vectors) corresponding to (from) at least one of particle contamination, mechanical surface damage, wafer spinning processes, scratching, and polishing. The motivation for doing so would have been to detect defects corresponding to at least one of particle contamination, mechanical surface damage, wafer spinning processes, scratching, and polishing.

Citation of Relevant Prior Art

47. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

[1]-[3] disclose methods and/or systems that detect wafer defects by comparison to defect records stored in a database of defect information.

[1] *U.S. Patent 5,917,332*. Chen et al. . Publication Date: June 1999.

[2] *U.S. Patent 6,603,873*. Gordon et al. Publication Date: August 2003

[3] *U.S. Patent 5,913,105*. McIntyre et al. Publication Date: June 1999.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Siangchin whose telephone number is (703)305-7569. The examiner can normally be reached on 9:00am - 5:30pm, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703)308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Kevin Siangchin

Examiner
Art Unit 2623

ks – 08/18/04

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